PATENT ABSTRACTS OF JAPAN

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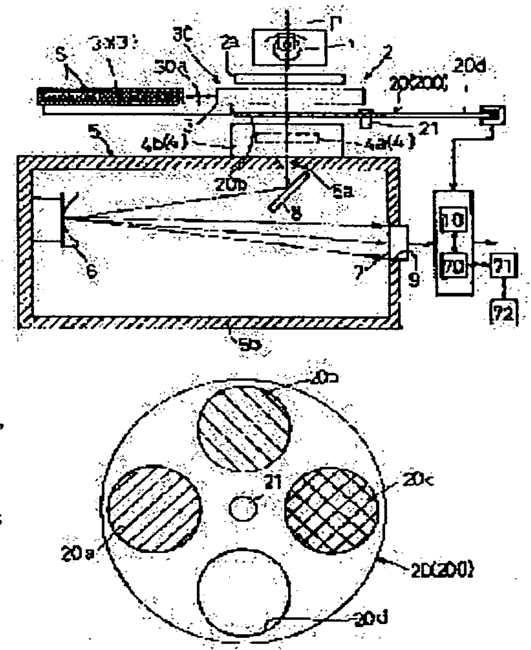
(54) SPECTROSCOPIC ANALYZER

(57)Abstract:
PURPOSE: To calibrate a wavelength in a short time according to environmental conditions by providing a wavelength calibrating part forming a bundle of rays for calibration between a light source and a spectroscopic means and detecting a change in position on a light receiving element of a wavelength peak existing on the bundle.



CONSTITUTION: A rotating disk 20 (switching means 200) for switching over a bundle of rays for measurement to a predetermined state is provided between a light source 1 and a spectroscopic analyzing part 5. When the bundle of rays for measurement is cast, the bundle which has transmitted through a wavelength calibration part (calibration filter) 20a formed on the disk 20 becomes a bundle of rays for calibration having peaks at a pair of specific wavelengths, so that an array-type light receiving element 7 can support it with a wavelength received at the element 7. At this time, a peak position detector 71 detects wavelength peak positions of the bundle for calibration on the element 7 as time proceeds, and a wavelength calibration confirming means 72 determines that an optical system has stabilized when a change in the light received positions is at a predetermined value or less. Thus unstable factors due to environmental conditions such as temperature can be eliminated, allowing an analyzer to be warmed up in a short time.

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CLAIMS

[Claim(s)]
[Claim 1] The light source to which the sample (S) of the measuring object irradiates the bundle of rays for measurement at the test section (30) in which **** is free (1), the spectrum which carries out the spectrum of the bundle of rays for measurement which reflects said test section (30) from transparency or said test section (30) -- with a means (6) the array mold photo detector (7) which receives said bundle of rays for measurement by which the spectrum was carried out -- having -- the optical-path top of said bundle of rays for measurement -- said light source (1) and said spectrum -- between means (6) The wavelength-calibration section (20a) equipped with the proofreading filter made into the proofreading bundle of rays which is made to penetrate said bundle of rays for measurement, and has the wavelength peak of a piece at least is prepared. It is spectral-analysis equipment which performs spectral analysis while performing a wavelength calibration. It has a peak location detection means (71) to detect with time the location change on said array mold photo detector (7) of said wavelength peak (A) which consists in said proofreading bundle of rays. Spectral-analysis equipment equipped with a wavelength-calibration check means (72) to distinguish that the wavelength calibration was completed when said location change with time became below a predetermined value.

[Translation done.]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention is a thing about the spectral-analysis equipment which analyzes components, such as grain proposed recently, by the spectral-analysis technique. Further in a detail The light source to which the sample of the measuring object irradiates the bundle of rays for measurement at the test section in which **** is free, the spectrum which carries out the spectrum of the bundle of rays for measurement which reflects a test section from transparency or a test section -- a means and the array mold photo detector which receives the bundle of rays for measurement by which the spectrum was carried out -- having -- the optical-path top of the bundle of rays for measurement -- the light source and a spectrum -- between means The wavelength-calibration section equipped with the proofreading filter made into the proofreading bundle of rays which is made to penetrate the bundle of rays for measurement, and has the wavelength peak of a piece at least is prepared, and it is related with the spectral-analysis equipment which performs spectral analysis, performing a wavelength calibration.
[0002]
[Description of the Prior Art] Since the configuration which calculates the amounts of components, such as grain, based on a measuring type is used for this kind of spectral-analysis equipment, recognition of of which frequency light is received by which component of an array mold photo detector is very important for it. Therefore, artificers performed the wavelength calibration for whenever [of sample measurement / every], and they have proposed the thing of the proofreading which detects, checking the correspondence relation between the frequency of the light received, and the component number in an array mold photo detector. And when proofreading in such configurations conventionally, the stable state of the light source and optical system was secured with the cure of carrying out fixed-after powering on time amount neglect, or not turning off the power for the purpose of stabilization of optical system, (guarantee). That is, warming up of several hours was conventionally carried out by the manual after powering on.
[0003]
[Problem(s) to be Solved by the Invention] However, simple, in usable component analysis equipment, since the environmental conditions, such as temperature, are not fixed, it is difficult [it] to make warming up time amount uniform on the spot. When warming up set up comparatively longer is performed for every measurement of a sample still as mentioned above, this takes a long time and the practicality as a device is missing. Therefore, the purpose of this invention is to obtain the spectral-analysis equipment which ** proofreading aiming at a wavelength calibration to an environment condition, and can perform it in a short time.
[0004]
[Means for Solving the Problem] When it has a peak location detection means detect with time the location change on the array mold photo detector of the wavelength peak which consists in a proofreading bundle of rays and a location change with time becomes below a predetermined value, having had a wavelength-calibration check means distinguished that the wavelength

calibration was completed has the description configuration of the spectral-analysis equipment by this invention for attaining this purpose. And its operation and effectiveness are as follows.
[0005]
[Function] That is, while the wavelength peak location which the spectral-analysis equipment of this application is equipped with a peak location detection means and a wavelength-calibration recognition means, for example, is in the proofreading bundle of rays with time on an array mold photo detector with a peak location detection means after powering on of the light source is detected, the location change situation of this wavelength peak location is grasped. And when this location change becomes below a predetermined value with a wavelength-calibration recognition means, it is distinguished that the stability of optical system was attained. Therefore, the problem of stabilization that it is influenced of environmental conditions, such as temperature, by the location in which spectral-analysis equipment is laid is solved rationally. Therefore, it is what **(ed) by the perimeter environment for about 10 - 40 minutes, and what had taken 2 hours (it becomes long in order to surely take an insurance side) for the former, for example, warming up, uniformly can be performed.
[0006]
[Effect of the Invention] therefore, in the spectral-analysis equipment of this application, the wavelength calibration which influences the precision of spectral analysis most can be made into certain and the thing which was excellent in respect of dependability and operability, while the accuracy of measurement is markedly alike and improves from the spectral-analysis equipment of the conventional configuration, in order to carry out for a short time. Generally, when the object which performs spectral analysis is component analysis, the quadratic differential value of the spectrum of the transmitted light in the specific wavelength of plurality (3-4 pieces) or the reflected light is made into the basic data of the measuring type which determines the amount of component analysis, but while being able to perform accuracy testing of this basic data by adopting the above-mentioned configuration, the quick nature of an activity is also securable. Therefore, even if it could cancel automatically the effect of degradation of the dirt of the container which contains rapid fluctuation of ambient temperature, secular change, and a sample, and the lamp as the light source etc. and performed full automatic operation, the spectral-analysis equipment which can maintain the accuracy of measurement was obtained.
[0007]
[Example] The spectral-analysis equipment which makes Sample S the cereals which are one example of the spectral-analysis equipment in this invention is explained below.
[0008] The first optical system 2 by which spectral-analysis equipment fabricates the bundle of rays for measurement from the light source 1 and the light source 1 as shown in drawing 1 , The sample attaching part 3 by which the bundle of rays for measurement from the first optical system 2 is irradiated, The second optical system 4 which condenses the bundle of rays for measurement which penetrated the sample S held by the sample attaching part 3, and the spectral-analysis section 5 which is an example of the light-receiving container which carries out spectral analysis of the bundle of rays for measurement condensed by the second optical system 4 are arranged in accordance with an optical axis P, and it constitutes.
[0009] Said first optical system 2 from which said light source 1 is constituted by the tungsten halogen lamp was equipped with lens 2a which fabricates the bundle of rays which goes to said sample attaching part 3 to a parallel pencil of rays, and it has the change means 200 which switches this bundle of rays to a predetermined condition on the optical axis P of the bundle of rays for measurement further between the light source 1 and the spectral-analysis section 5 (setting in the example the spectral-analysis section 5 side of the sample attaching part 3). As this change means 200 is equipped with the rotating disk 20 which rotates to the circumference of an axis and it is shown in drawing 2 , a rotating disk 20 Wavelength-calibration section 20a equipped with the proofreading filter which is made to penetrate the bundle of rays for measurement, and is made into a proofreading bundle of rays, The hoop direction is equipped with 20d of notches which pass reference section 20b which is made to penetrate the bundle of rays for measurement, and is made into a reference bundle of rays, covered section 20c for dark current measurement which intercepts the bundle of rays for measurement, and the bundle of

rays for measurement as it is. And when a rotating disk 20 rotates to the circumference of a revolving shaft 21, the condition of the transmitted light is switched to each condition. Here, the time interval to which the bundle of rays for measurement penetrates each part can be set as arbitration by controlling the rotational frequency of a rotating disk 20. Now, as shown in drawing 3 , the above-mentioned proofreading bundle of rays is a bundle of rays equipped with the specific wavelength region (lambda1lambda2) peak of a pair at least, and can take correspondence between each component which constitutes an array mold photo detector, and the wavelength of the light which each component receives from the physical relationship of the correspondence component location of the array mold photo detector 7 which will receive the peak wavelength and such peak wavelength of the pair specified beforehand.

[0010] Container 3a made from silica glass constitutes said sample attaching part 3, and it has held the grain as a sample S in the container 3a. This container 3a is constituted free [****] in preparation for the condition of estranging from the condition of crossing an optical axis P, and an optical axis P, to the test section 30 along which the optical axis P of the bundle of rays for measurement passes, in **** means 30a so that it may illustrate. Said second optical system 4 consists of condenser lens 4a which makes the bundle of rays which penetrated said sample S condense in the incidence hole 5a location of said spectral-analysis section 5, and black box 4b which prevents penetration of the harmful light to an optical path.

[0011] black box 5b made from aluminum which carries out proximal [of said spectral-analysis section 5] to said second optical system 4 -- preparing -- the inside of the black box 5b -- an incident ray bundle -- a spectrum -- the spectrum to reflect -- the concave grating 6 as a means, and a spectrum -- the array mold photo detector 7 which detects the reflected bundle-of-rays reinforcement for every wavelength is formed, and it constitutes. Moreover, between said incidence hole 5a in the optical path for measurement in said black box 5b, and said concave grating 6, the reflecting mirror 8 made to turn and reflect the incident ray bundle from said incidence hole 5a in a concave grating 6 is formed. That is, said spectral-analysis section 5 is the spectrometer of a polychromator mold.

[0012] Fixed installation has been carried out at the photo detector fixed part 9 prepared in said black box 5b on the distributed optical path of the bundle of rays by said concave grating 6, and said array mold photo detector 7 consists of silicon (Si), a plumbous sulfide (PbS), or a germanium (germanium) sensor. The detecting signal from this array mold photo detector 7 is sent to the processing means 70, it is processed by this processing means 70, and spectrum related information, such as a quadratic differential value of that processed spectrum and a spectrum, is called for. Furthermore, linkage with the above-mentioned change means 200 and the processing means 70 is taken by the control means 10. And it is constituted so that each component value can be computed according to the measuring type stored in the processing means 70 from spectrum related information. Now, with this processing means 70, it has the peak location detection means 71 and the wavelength-calibration check means 72 for checking the stabilization condition of the wavelength calibration which is the description configuration of this application, and this optical system, and is constituted by the equipment of this application. First, based on drawing 4 , work of the peak location detection means 71 is explained. In this drawing, an axis of abscissa shows the component array condition (a component number increases as it estranges from an axis of ordinate) of the above-mentioned array mold photo detector, and the axis of ordinate shows the quantity of light which each component receives. The wavelength region to illustrate is a thing near [which receives light near / which is planned if a wavelength peak is beforehand formed in the transmitted light of a proofreading filter / the wavelength] the component. By interpolating the quantity of light data of a total of seven points of three points to a specific main wavelength component (shown on [a1] drawing) approximately, respectively, as A shows to drawing 4 , it is a wavelength peak location (in the location corresponding to the component number in an array mold photo detector). 1/100 unit of the distance set up by the component number -- a wavelength peak location -- deducing -- it asks. In this drawing, the continuous line, the broken line, and the alternate long and short dash line show change of a peak location with time. Now, the peak location data caught by doing in this way are memorized for every measurement time, and the comparison with the last peak

location data is made. And when the variation of peak location data is settled within constant value, it has the wavelength-calibration check means 72 to which it is supposed that the wavelength calibration of optical system was completed. These means are specifically the processing configurations on software. Although a wavelength calibration is completed in fact by [as shown in drawing 3 with such a migration check of a peak location / which take the correspondence relation between the wavelength of the wavelength peak location of a pair, and a component number at least], the check of the calibration accuracy accompanying stabilization is completed by the former check.

[0013] According to drawing 5 R> 5, a structured format explains the sequence of the spectral-analysis equipment of this application of operation below. Processing of data is performed by the processing means 70 interlocked with the above-mentioned change means 200.

1 Measurement Initiation (Wavelength Configuration Data Collection Process-First Stage Story)

This condition is in the condition shown in drawing 5 (b), container 3a is held to the test section 30 at the condition of having returned to private life, and there is nothing in a test section 30. On the other hand, a rotating disk 20 takes the condition that wavelength-calibration section 20a which is in the zero condition is located on an optical axis P. And if the bundle of rays for measurement is irradiated, the bundle of rays which penetrated this wavelength-calibration section 20a is made into the proofreading bundle of rays which has a peak on the specific wavelength (lambda1lambda2) of a pair, this proofreading bundle of rays will be received by the array mold photo detector 7, and the correspondence of it with each component and wavelength will be attained. This is performed for every sample measurement. At this time, the above-mentioned peak location detection means 71 and the above-mentioned wavelength-calibration check means 72 work, and the check of the stability of optical system and the check of the wavelength which each component with which an array mold photo detector is equipped receives are performed. Now, the condition of change of the peak wavelength location behind powering on in this working state was shown in drawing 6 . the drawing 6 (**) -- the peak location of wavelength where (**)s differed, respectively -- being shown -- **** -- being with time at intervals of 5 minutes what is illustrated -- setting -- -- a wavelength peak location is calculated by the peak location detection means 71, and 25 minute or subsequent ones when light-receiving location change of proofreading with a wavelength of 740.0nm becomes 0.03 or less with the wavelength-calibration check means 72 is judged that the stable state of optical system is acquired. Thus, the data collection of a wavelength calibration is completed.

2 Reference Data Collection Process (Second Stage Story)

This condition is in the condition shown in drawing 5 (b), like said process, container 3a is held to the test section 30 at the condition of having returned to private life, and there is nothing in a test section 30. On the other hand, a rotating disk 20 takes the condition that rotate and reference section 20b is located on an optical axis P. And if the bundle of rays for measurement is irradiated, the bundle of rays which penetrated this reference section 20b will be made into reference light by penetrating the references (rubbing glass etc.) in a measurement condition (temperature), and a reference source Rd will be obtained.

3 Dark Information Gathering Process (Third Step)

This condition is in the condition shown in drawing 5 (Ha), a rotating disk 20 rotates and covered section 20c for dark current measurement is located on an optical axis. Therefore, in this condition, ON light of the light is not carried out to the array mold photo detector 7, but the dark information D in a measurement condition is acquired. On the other hand, container 3a to which restoration of the sample into container 3a was performed is moved to a test section 30.

4 Perform a wavelength calibration (processing on software) in the processing means 70 after ending the process of the wavelength-calibration processing-process above. That is, the wavelength of the light received by the component of the component number p of arbitration is derived from the relation between the peak wavelength (lambda1, lambda2) of said pair, and the number of the component of the pair which receives this for example, with primary relational expression.

5 Sample Data Collection Process (Fourth Step)

This condition is in the condition shown in drawing 5 (d), container 3a is located in the test

section 30, and measuring beam pencil of lines will penetrate a sample. On the other hand, a rotating disk 20 takes the condition that rotate and 20d of notches is located on an optical axis P. Therefore, the bundle of rays for measurement is irradiated and the sample information Sd can be acquired by receiving the transmitted light which has penetrated the sample.
6 According to the following formulas, the absorbance d as information on a spectrum condition is obtained from the sample information Sd acquired in process of the calculation process above of an absorbance and other spectrum data, reference source Rd, and the dark information D.
Absorbance d=log ((Rd-D)/(Sd-D))
Furthermore, spectrum related information, such as a quadratic differential value in the wavelength field of the above-mentioned absorbance spectrum and a spectrum, is obtained and outputted. Furthermore, the quadratic differential value of the spectrum in two or more specific wavelength is used, and the component value of each components in a sample (moisture, protein, etc.) is calculated. In this operation, in the spectral-analysis equipment of this application, since a wavelength calibration, reference measurement, and dark output measurement are performed for every measurement, the amount of components can be specified correctly. Therefore, the dependability of measurement improves.
[0014] [Other Example(s)]
(**) the thermal radiator (blackbody furnace) as the light source 1 which cannot limit to this, can set up suitably according to Sample S and the measurement purpose, and has continuous radiation throughout infrared radiation although the tungsten halogen lamp is used for the light source 1 in the previous example -- in addition, the light source 1 of a mercury-vapor lamp, Ne discharge tube, etc., the laser which emits light in the homogeneous light for measuring Raman scattering can be used, and the configuration can also be changed suitably.
(**) In the further above-mentioned example, although the bundle of rays for measurement which penetrates Sample S analyzed, it is good also considering this as the reflected light.
[0015] (**) Although it was made to pass through each phase by equipping a change means with a rotating disk and rotating this in the above-mentioned example As shown in drawing 7 , at least each part only equips the plate-like member 22 with (wavelength-calibration section 20a, reference section 20b, covered section 20for dark current measurement c, 20d of notches), and it is good by moving this member 22 to an optical axis P also as what determines the condition of the bundle of rays for measurement.
(**) In the further above-mentioned example, although the sample container was moved to the test section in the third step, this has just only realized the condition that Sample S is in a test section 30 in the fourth step. A means to perform this is called a **** means.
(**) In the above-mentioned example, although the example which calculates a component analysis value (component content) from an absorbance quadratic differential spectrum was shown, this can also be constituted so that a flavor value may be calculated, when a sample is rice.
[0016] In addition, although a sign is described in order to make contrast with a drawing convenient at the term of a claim, this invention is not limited to the configuration of an accompanying drawing by this entry.

[Translation done.]

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審査請求　未請求　請求項の数１　ＯＬ　（全６頁）

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(54)【発明の名称】分光分析装置

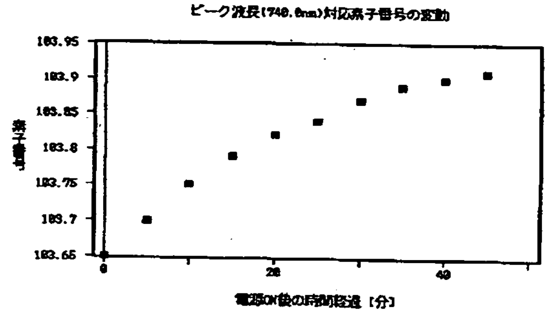
(57)【要約】

【目的】　波長校正を短時間に環境状態に則しておこなうことができる分光分析装置を得る。

【構成】　測定対象のサンプルが出退自在な測定部に測定用光線束を照射する光源と、測定部を透過してくる測定用光線束を分光する分光手段と、分光された測定用光線束を受光するアレイ型受光素子とを備え、測定用光線束の光路上で光源と分光手段との間に、測定用光線束を透過させて少なくとも一個の波長ピークを有する校正光線束とする校正フィルタを備えた波長校正部を設け、波長校正をおこないながら分光分析をおこなう分光分析装置に、校正光線束に存する波長ピークのアレイ型受光素子上における位置変化を経時的に検出するピーク位置検出手段を備え、経時的な位置変化が所定値以下となった場合に波長校正が完了したと判別する波長校正確認手段を備える。

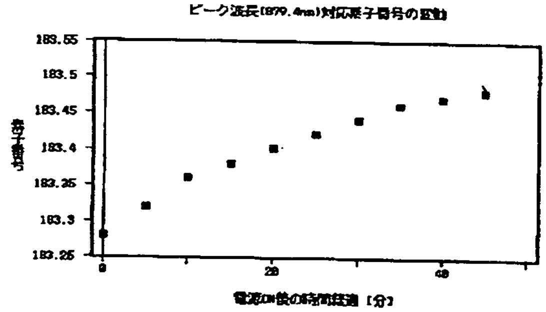
（イ）

ピーク波長(740.0nm)対応素子番号の変動



（ロ）

ピーク波長(879.4nm)対応素子番号の変動



【特許請求の範囲】

【請求項１】　測定対象のサンプル（Ｓ）が出退自在な測定部（３０）に測定用光線束を照射する光源（１）と、前記測定部（３０）を透過もしくは前記測定部（３０）より反射してくる測定用光線束を分光する分光手段（６）と、分光された前記測定用光線束を受光するアレイ型受光素子（７）とを備え、前記測定用光線束の光路上で前記光源（１）と前記分光手段（６）との間に、前記測定用光線束を透過させて少なくとも一個の波長ピークを有する校正光線束とする校正フィルタを備えた波長校正部（２０ａ）を設け、波長校正をおこないながら分光分析をおこなう分光分析装置であって、前記校正光線束に存する前記波長ピーク（Ａ）の前記アレイ型受光素子（７）上における位置変化を経時的に検出するピーク位置検出手段（７１）を備え、経時的な前記位置変化が所定値以下となった場合に波長校正が完了したと判別する波長校正確認手段（７２）を備えた分光分析装置。

【発明の詳細な説明】

【０００１】

【産業上の利用分野】本発明は、最近提案されている穀物等の成分を分光分析手法により分析する分光分析装置に関するものであり、さらに詳細には、測定対象のサンプルが出退自在な測定部に測定用光線束を照射する光源と、測定部を透過もしくは測定部より反射してくる測定用光線束を分光する分光手段と、分光された測定用光線束を受光するアレイ型受光素子とを備え、測定用光線束の光路上で光源と分光手段との間に、測定用光線束を透過させて少なくとも一個の波長ピークを有する校正光線束とする校正フィルタを備えた波長校正部を設け、波長校正をおこないながら分光分析を行う分光分析装置に関する。

【０００２】

【従来の技術】この種の分光分析装置は、穀物等の成分量を検量式に基づいて求める構成を採用しているため、どの周波数の光がアレイ型受光素子のどの素子に受光されているかの認識が非常に重要である。従って、発明者らは、例えばサンプル測定の度毎に波長校正をおこなって、受光される光の周波数とアレイ型受光素子における素子番号との対応関係を確認しながら、検出をおこなう校正のものを提案している。そして、従来、こういった構成において校正を行う場合、例えば光学系の安定化を目的として電源投入後一定時間放置する、あるいは電源を切らない等の対策により、光源、光学系の安定状態を確保（保証）していた。即ち、従来は、電源投入後、数時間のウォーミングアップをマニュアルで実施していた。

【０００３】

【発明が解決しようとする課題】しかし、現場で簡便に使用可能な成分分析装置においては温度等の環境条件が一定ではないために、ウォーミングアップ時間を一律にすることは困難である。さらに上記のようにサンプルの測定毎に、比較的長めに設定されているウォーミングアップをおこなうと、これに長時間を要してしまい、機器としての実用性に欠ける。従って本発明の目的は、波長校正を目的とする校正を短時間に環境状態に則しておこなうことができる分光分析装置を得ることにある。

【０００４】

【課題を解決するための手段】この目的を達成するための本発明による分光分析装置の特徴構成は、校正光線束に存する波長ピークのアレイ型受光素子上における位置変化を経時的に検出するピーク位置検出手段を備え、経時的な位置変化が所定値以下となった場合に、波長校正が完了したと判別する波長校正確認手段を備えたことにある。そして、その作用・効果は次の通りである。

【０００５】

【作用】つまり、本願の分光分析装置はピーク位置検出手段と波長校正認識手段とを備え、例えば光源の電源投入後、ピーク位置検出手段により、アレイ型受光素子上における経時的な校正光線束にある波長ピーク位置が検出されるとともに、この波長ピーク位置の位置変化状況が把握される。そして、波長校正認識手段により、この位置変化が所定値以下となった場合に、光学系の安定が達成されたと判別される。従って、分光分析装置の載置される場所により温度等の環境条件の影響を受ける安定化の問題が合理的に解決される。従って、従来、例えばウォーミングアップに一律２時間（どうしても安全サイドを取るため長くなる）掛かっていたものを、１０～４０分程度の、周囲環境に則したものでおこなうことができる。

【０００６】

【発明の効果】従って、本願の分光分析装置においては、分光分析の精度に最も影響する波長校正を、確実且つ短時間で行うこととなるため、従来構成の分光分析装置より測定精度が格段に向上するとともに、信頼性、操作性の点で優れたものとすることができる。一般に、分光分析をおこなう対象が成分分析である場合には、複数（３～４個）の特定波長における透過光もしくは反射光のスペクトルの二次微分値が、成分分析量を決定する検量式の基礎データとされるが、この基礎データの精度確認を上記の構成を採用することによりおこなえるとともに、作業の迅速性も確保できる。従って、雰囲気温度の急激な変動や経年変化、サンプルを収納する容器の汚れ、光源としてのランプの劣化などの影響を自動的にキャンセルでき、全自動運転を行っても、測定精度が維持できる分光分析装置が得られた。

【０００７】

【実施例】以下に本発明における分光分析装置の一実施例である穀類をサンプルＳとする分光分析装置について説明する。

【０００８】分光分析装置は、図１に示すように、光源

１と、光源１からの測定用光線束を成形する第一光学系２と、第一光学系２からの測定用光線束が照射されるサンプル保持部３と、そのサンプル保持部３で保持されたサンプルＳを透過した測定用光線束を集光する第二光学系４と、その第二光学系４により集光された測定用光線束を分光分析する受光容器の一例である分光分析部５とを光軸Ｐに沿って配置して構成してある。

【０００９】前記光源１は、タングステン－ハロゲン電球によって構成してある前記第一光学系２は、前記サンプル保持部３に向かう光線束を平行光線束に成形するレンズ２ａを備え、さらに測定用光線束の光軸Ｐ上で光源１と分光分析部５との間（実施例においてはサンプル保持部３の分光分析部５側）に、この光線束を所定の状態に切換える切換え手段２００を備えている。この切換え手段２００は、軸芯周りに回転する回転円板２０を備えており、図２に示すように回転円板２０は、測定用光線束を透過させて校正光線束とする校正フィルタを備えた波長校正部２０ａと、測定用光線束を透過させてリファレンス光線束とするリファレンス部２０ｂと、測定用光線束を遮断する暗電流測定用遮蔽部２０ｃと測定用光線束をそのまま通過させる切欠き部２０ｄとを周方向に備えている。そして、回転円板２０が回転軸２１周りに回転することにより、それぞれの状態に透過光の状態が切換えられる。ここで、回転円板２０の回転数を制御することにより、各部を測定用光線束が透過する時間間隔を任意に設定できる。さて、前述の校正光線束は図３に示すように、少なくとも一対の特定波長域（$\lambda_1 \lambda_2$）ピークを備えた光線束であり、予め特定されている一対のピーク波長とこれらのピーク波長を受光することとなるアレイ型受光素子７の対応素子位置の位置関係から、アレイ型受光素子を構成する各素子と、それぞれの素子が受光する光の波長との間で対応を取ることができる。

【００１０】前記サンプル保持部３は、石英硝子製の容器３ａによって構成してあり、その容器３ａ内には、サンプルＳとしての穀物を収容してある。この容器３ａは図示するように、測定用光線束の光軸Ｐが通っている測定部３０に対して、光軸Ｐを横切る状態と光軸Ｐから離間する状態とに出退手段３０ａを備えて出退自在に構成されている。前記第二光学系４は、前記サンプルＳを透過した光線束を前記分光分析部５の入射孔５ａ位置で集光させる集光レンズ４ａと、光路への有害光の進入を防止する暗箱４ｂとで構成してある。

【００１１】前記分光分析部５は、前記第二光学系４に隣設するアルミニウム製の暗箱５ｂを設け、その暗箱５ｂ内で、入射光線束を分光反射する分光手段としての凹面回折格子６と、分光反射された各波長毎の光線束強度を検出するアレイ型受光素子７とを設けて構成してある。また、前記暗箱５ｂ内の測定用光路における前記入射孔５ａと前記凹面回折格子６との間には、前記入射孔５ａからの入射光線束を凹面回折格子６に向けて反射させる反射鏡８を設けてある。即ち、前記分光分析部５はポリクロメータ型の分光計である。

【００１２】前記アレイ型受光素子７は、前記凹面回折格子６による光線束の分散光路上の前記暗箱５ｂに設けた受光素子固定部９に固定設置してあり、シリコン（Ｓｉ）又は硫化鉛（ＰｂＳ）又はゲルマニウム（Ｇｅ）センサで構成してある。このアレイ型受光素子７からの検出信号は、処理手段７０に送られ、この処理手段７０により処理され、その処理済スペクトル、スペクトルの二次微分値等のスペクトル関連情報が求められる。さらに、前述の切換え手段２００と処理手段７０との連係が制御手段１０によって採られている。そして、スペクトル関連情報から処理手段７０に格納されている検量式に従って、各成分値が算出できるように構成されている。さて、本願の装置には、この処理手段７０とともに、本願の特徴構成である波長校正とこの光学系の安定化状態を確認するためのピーク位置検出手段７１及び波長校正確認手段７２を備えて構成されている。まず、図４に基づいてピーク位置検出手段７１の働きについて説明する。同図において横軸は前述のアレイ型受光素子の素子配列状態（縦軸から離間するに従って素子番号が増加する）を示し、縦軸は各素子が受光する光量を示している。図示する波長域は予め校正フィルタの透過光において波長ピークが形成されると予定されている波長近傍を受光する素子近傍のものであり、特定の中心波長素子（図上ａ１で示す）に対して夫々前後３点の計７点の光量データを内挿することにより、図４にＡで示すように波長ピーク位置（アレイ型受光素子における素子番号に対応する位置で、素子番号で設定される距離の１／１００単位で波長ピーク位置を割り出す）が求められる。同図において、実線、破線、一点鎖線は経時的なピーク位置の変化を示している。さて、このようにして捕らえられるピーク位置データは測定回毎に記憶され、前回のピーク位置データとの比較がなされる。そして、ピーク位置データの変化量が一定値以内に収まった場合に、光学系の波長校正を完了したとする波長校正確認手段７２を備えている。これらの手段は、具体的にはソフトウエア上の処理構成である。実際には、この様なピーク位置の移動確認とともに、図３に示すような少なくとも一対の波長ピーク位置の波長と、素子番号との対応関係を取ることにより、波長校正は完了するが、安定化に伴う校正確度の確認は前者の確認で完了する。

【００１３】以下に本願の分光分析装置の動作順序を図５に従って箇条書き形式で説明する。データの処理は前述の切換え手段２００と連動した処理手段７０によりおこなわれる。

１　測定開始（波長構成データ収集過程－第一段階）

この状態は、図５（イ）に示される状態であり、測定部３０に対して容器３ａは引退した状態に保持されており、測定部３０には何もない。一方、回転円板２０はそ

の原点状態である波長校正部２０ａが光軸Ｐ上に位置される状態をとる。そして、測定用光線束が照射されると、この波長校正部２０ａを透過した光線束は、一対の特定波長（$\lambda_1\lambda_2$）にピークを有する校正光線束とされ、この校正光線束がアレイ型受光素子７によって受光され、各素子と波長との対応が可能となる。これは、サンプル測定毎におこなわれる。この時、前述のピーク位置検出手段７１と波長校正確認手段７２とが働き、光学系の安定性の確認及び、アレイ型受光素子に備えられる各素子が受光する波長の確認がおこなわれる。さて、この作業状態に於ける電源投入後のピーク波長位置の変化の状態を図６に示した。図６（イ）（ロ）は夫々異なった波長のピーク位置を示しており、経時的（図示するものにおいては５分間隔で）に、波長ピーク位置がピーク位置検出手段７１により算定され、波長校正確認手段７２により、例えば波長７４０．０ｎｍの校正の受光位置変化が０．０３以下になる２５分以降を光学系の安定状態が得られていると判断する。このようにして波長校正のデータ収集を完了する。

２　リファレンスデータ収集過程（第二段階）
この状態は、図５（ロ）に示される状態であり、前記過程と同様に、測定部３０に対して容器３ａは引退した状態に保持されており、測定部３０には何もない。一方、回転円板２０は回転してリファレンス部２０ｂが光軸Ｐ上に位置される状態をとる。そして、測定用光線束が照射されると、このリファレンス部２０ｂを透過した光線束は、測定状態（温度）にあるリファレンス（摩りガラス等）を透過することによりリファレンス光とされ、リファレンス情報Ｒｄが得られる。

３　暗情報収集過程（第三段階）
この状態は、図５（ハ）に示される状態であり、回転円板２０は回転して暗電流測定用遮蔽部２０ｃが光軸上に位置される。従って、この状態においては、アレイ型受光素子７へ光は入光せず、測定状態における暗情報Ｄが得られる。一方、容器３ａ内へのサンプルの充填がおこなわれた容器３ａが測定部３０に移動される。

４　波長校正処理過程
上記の過程を終了した後、処理手段７０内において波長校正（ソフト上の処理）をおこなう。即ち、任意の素子番号ｐの素子に受光される光の波長を、前記一対のピーク波長（λ_1，λ_2）とこれを受光する一対の素子の番号との関係から例えば一次関係式で導出する。

５　サンプルデータ収集過程（第四段階）
この状態は、図５（ニ）に示される状態であり、測定部３０に容器３ａは位置されており、測定光線束はサンプルを透過してくることとなる。一方、回転円板２０は回転して切欠き部２０ｄが光軸Ｐ上に位置される状態をとる。従って、測定用光線束が照射され、サンプルを透過してきた透過光を受光することによりサンプル情報Ｓｄを得ることができる。

６　吸光度、その他のスペクトルデータの算出過程
上記の過程で得られている、サンプル情報Ｓｄ、リファレンス情報Ｒｄ、暗情報Ｄより、以下の式に従ってスペクトル状態の情報としての吸光度ｄが得られる。
吸光度　ｄ＝ｌｏｇ（（Ｒｄ－Ｄ）／（Ｓｄ－Ｄ））
さらに、上記の吸光度スペクトル、スペクトルの波長領域における二次微分値等のスペクトル関連情報が得られ、出力される。さらに、複数の特定波長におけるスペクトルの二次微分値を使用して、サンプル内の各成分（水分、タンパク等）の成分値が求められる。この演算において、本願の分光分析装置においては、波長校正、リファレンス測定、暗出力測定が測定毎におこなわれるため、成分量の特定を正確におこなうことができる。従って、測定の信頼性が向上する。

【００１４】〔別実施例〕
（イ）　先の実施例では、光源１にタングステンーハロゲン電球を用いているが、これに限定するものではなく、サンプルＳ及び測定目的に応じて適宜設定可能であり、赤外線全域で連続スペクトル放射を持つ光源１としての熱放射体（黒体炉）や、その他水銀灯、Ｎｅ放電管等の光源１や、ラマン散乱を測定するための単色光を発光するレーザ等を用いることができ、その構成も適宜変更可能である。
（ロ）　さらに、上記の実施例においては、サンプルＳを透過してくる測定用光線束によって分析をおこなったが、これを反射光としてもよい。
【００１５】（ハ）　上記の実施例においては、切換え手段に回転円板を備えて、これを回転させることにより各段階を経るようにしたが、図７に示すように、単に平板状の部材２２に各部位（波長校正部２０ａ、リファレンス部２０ｂ、暗電流測定用遮蔽部２０ｃ、切欠き部２０ｄ）を備えておき、この部材２２を光軸Ｐに対して移動させることにより測定用光線束の状態を決定するものとしてもよい。
（ニ）　さらに、上記の実施例においては、第三段階においてサンプル容器を測定部に移動させたが、これは単に第四段階でサンプルＳが測定部３０にある状態を実現できていればよい。これを実行する手段を出退手段と呼ぶ。
（ホ）　上記の実施例においては、吸光度二次微分スペクトルより成分分析値（成分含有率）を求める例を示したが、これは試料が米の場合、食味値を求める様に構成することも可能である。
【００１６】尚、特許請求の範囲の項に図面との対照を便利にするために符号を記すが、該記入により本発明は添付図面の構成に限定されるものではない。
【図面の簡単な説明】
【図１】分光分析装置の構成を示す図
【図２】回転円板の構成を示す図
【図３】校正光線束の状態を示す図

【図4】校正光線束におけるピーク位置の変化の状態の説明図

【図5】各測定状態に於ける光源、サンプル容器、回転円板、分光分析部の位置関係を示す図

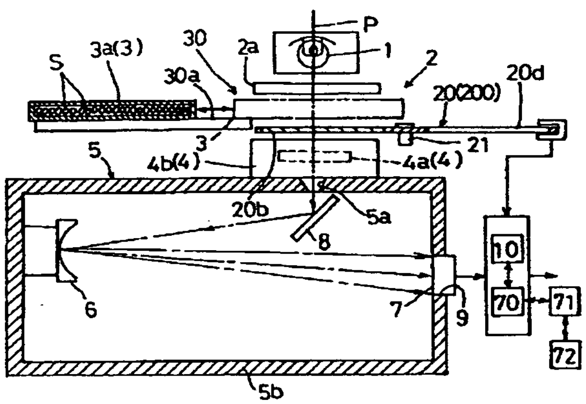
【図6】ピーク位置の経時的な変化状態を示す図

【図7】切換え手段の別構成例を示す図

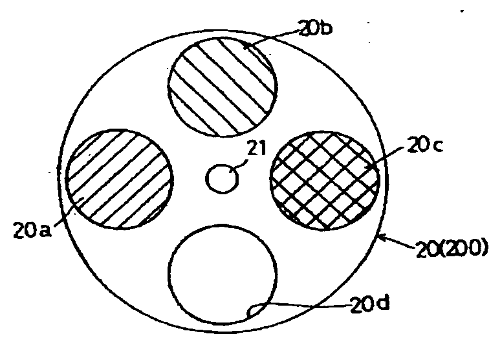
【符号の説明】

1　光源
6　分光手段
7　アレイ型受光素子
10　制御手段
20a　波長校正部
20b　リファレンス部
20c　暗電流測定用遮蔽部
20d　切欠き部
30　測定部
71　ピーク位置検出手段
72　波長校正確認手段
200　切換え手段

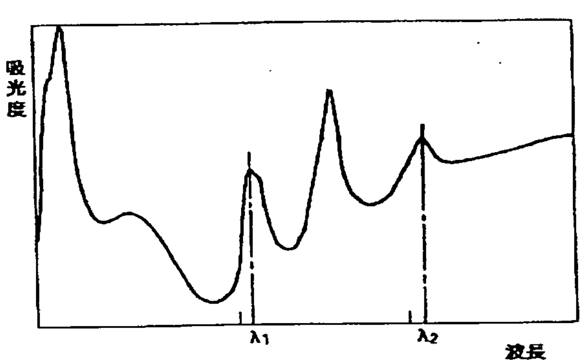
【図1】



【図2】

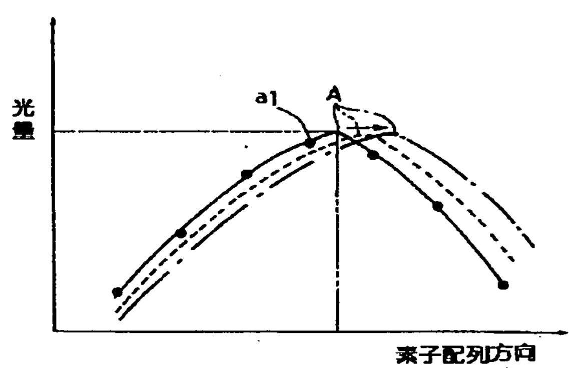


【図3】

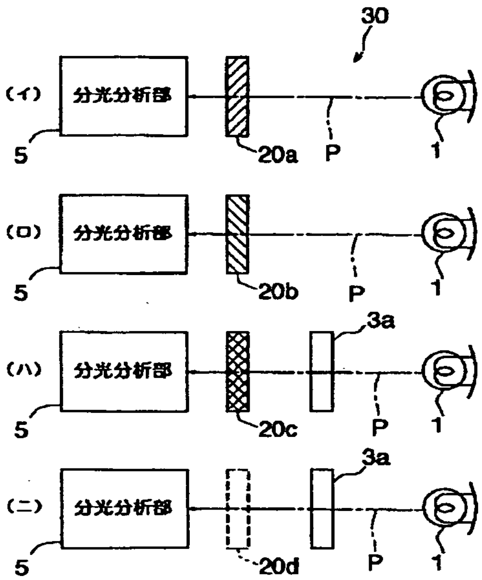


波長校正用フィルタを用いた波長補正

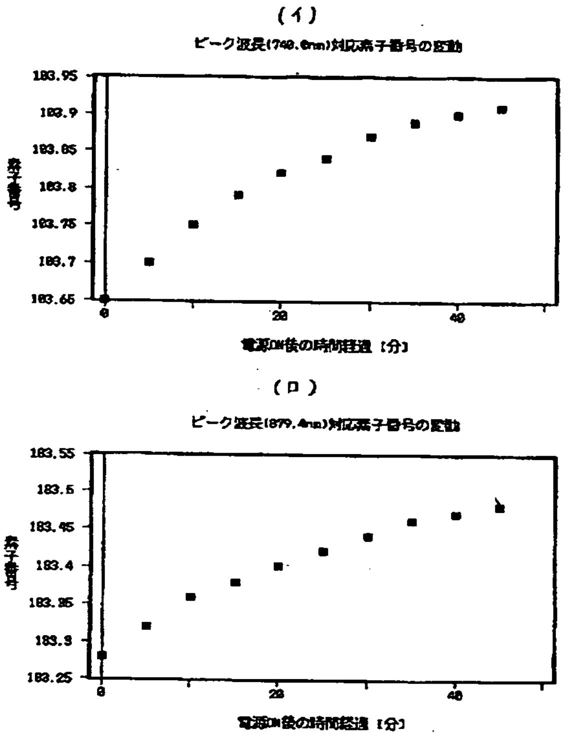
【図4】



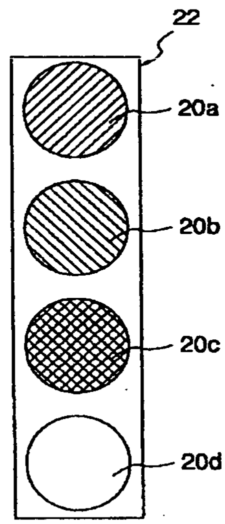
【図5】


30
(イ)
分光分析部
5
20a
P
1
(ロ)
分光分析部
5
20b
P
1
(ハ)
分光分析部
5
20c
3a
P
1
(ニ)
分光分析部
5
20d
3a
P
1

【図6】


(イ)
ピーク波長(740.0nm)対応素子番号の変動
183.95
183.9
183.85
183.8
183.75
183.7
183.65
素子番号
0
20
40
電源ON後の時間経過 [分]
(ロ)
ピーク波長(879.4nm)対応素子番号の変動
183.55
183.5
183.45
183.4
183.35
183.3
183.25
素子番号
0
20
40
電源ON後の時間経過 [分]

【図7】


22
20a
20b
20c
20d